**N111: Pharmacology Blue Print Exam-1**

**HINT: READ THE QUESTIONS AT THE END OF THE CHAPTERS**

**Chapter 7:**

**Pregnancy Drug Categories (Table 7.1)**  1

* + - **Category A🡪**Adequate and well-controlled studies have failed to demonstrate a risk to the fetus in the first trimester of pregnancy (and there is no evidence of risk in later trimesters).
    - **Category B🡪** Animal reproduction studies have failed to demonstrate a risk to the fetus and there are no adequate and well-controlled studies in pregnant women.

**OR**

* + - Animal studies have shown an adverse affect, but adequate and well-controlled studies in pregnant women have failed to demonstrate risk to the fetus in any trimester.
    - **Category C🡪** Animal reproduction studies have shown an adverse effect on the fetus and there are no adequate and well-controlled studies in pregnant women.

**OR**

* + - No animal studies have been conducted and there are no adequate and well-controlled studies in pregnant women.
    - **Category D**🡪 Adequate, well controlled or observational studies in pregnant women have demonstrated a risk to the fetus.
      * However, the benefits of therapy may outweigh the potential risk. For example, the drug may be acceptable if needed in life-threatening situation or serious disease for which safer drugs cannot be used or are ineffective.
    - **Category X🡪** Adequate well-controlled or observational studies in animals or pregnant women have demonstrated positive evidence of fetal abnormalities or risks.
      * The use of the product is contraindicated in women who are, or may become pregnant. There is no indication for use in pregnancy

**Pharmacotherapy of Infants/Toddlers**  1

* **Pharmacotherapy of Infants** (7.5)
  + Birth to 1y
  + Neonates = first 28 days
  + A big concern: the spitting out of medications, because it is difficult to estimate the amount lost
    - Vomiting immediately after administration warrants reordering of dose
  + Oral medications 🡪 inner cheek; allow time to swallow
  + IM meds 🡪 vastus lateralus muscle
  + IV meds 🡪 feet and scalp veins
* **Pharmacotherapy of Toddlers** (7.6)
  + Age 1-3 years
  + Teach parents about poisoning avoidance
    - Especially important for yummy, flavored liquid medications
    - NEVER tell children that medicine is candy
    - Keep poison control # near phones
  + Lock up all meds/cleaning supplies and use child-proof containers
  + Give short, concrete explanations to toddlers followed immediately by administration
    - Provide physical comfort (touch, hug, verbal praise) following administration
  + Mix bad-tasting meds with small amount of jam, syrup, or fruit puree
    - Don’t use milk, OJ, or cereal or child might associate healthy things with bad taste
  + IM meds 🡪 vastus lateralus muscle
  + IV meds 🡪 feet and scalp veins
  + Restraint may be necessary at this age

**Chapter8:**

**Genetic influences on pharmacotherapy**  1

* + Pharmacogenetics – the study of genetic variations that give rise to differences in the way patients handle medications
  + Genetic polymorphism – 2 or more versions of the same enzyme
    - A single base mutation in DNA can result in an amino acid change in a metabolic enzyme, which alters its function
    - Tendencies toward these mutations are often identified within specific ethnic groups (people who are genetically similar to each other)
  + 4 common polymorphisms:

|  |  |  |
| --- | --- | --- |
| **Enzyme** | **Result of Polymorphism** | **Drugs using this Enzyme/ Pathway** |
| Acetyltransferase | Slow acetylation in Scandinavians, Jews, North African Caucasians (reduced hepatic metabolism 🡪risk for toxicity)  Fast acetylation in Japanese | Caffeine, hydralazine, isonazid (INH), procainamide |
| Debrisoquin hydroxylase | Poorly metabolized in Asian Americans (who lack this enzyme) | Codeine (which can’t be metabolized into morphine) |
| Renin | Decreased effect of beta adrenergic drugs in African Americans | haloperidol, propanolol, metoprolol |
| Mephenytoin hydroxylase | Poorly metabolized in Asians and African Americans | Diazepam, imipramine, barbiturates, warfarin |

**Gender influence on Pharmacotherapy 1**

* + Women tend to pay more attention to changes in their health and seek medical attention sooner
  + Up to 3x as many women suffer from Alzheimer’s
  + Adherence to medication regimens can be influenced by gender-specific side-effects
    - some antihypertensives can cause/worsen male impotence
    - several drugs can cause gynecomastia (embarrassing to men)
    - some medications cause masculinizing effects (embarrassing to women)
    - BCP causes increased risk of thromboembolytic disorders
  + Physiological differences between men and women:
    - Fat-to-muscle ratio
    - Cerebral blood flow (response to analgesics)
    - Elimination rates (slower elimination of benzodiazepines in women, exacerbated by BCP)
  + Past drug research studies were only conducted on men
  + Gender inequity is a resolving issue

**Chapter 9:**

**Factors contributing to medical errors 2**

* + HCP Errors
    - Omitting one of the rights of drug administration (right patient, right drug, right dose, right route, right time, right documentation)
    - Failing to perform an agency system check (accuracy and appropriateness of drug orders)
    - Failing to account for patient variables (age, body size, impaired organ systems)
    - Giving medications based on verbal/phone orders, which may be misinterpreted or go undocumented.
      * Nurses should remind the prescriber that orders must be in writing before the drug can be administered
      * *(Next best thing – Dr. gives an order over the phone, then comes and signs it after the fact)*
    - Giving medications based on incomplete/illegible orders
      * Orders also should not contain confusing abbreviations!
    - Practicing under stress
      * Increased number of errors with increased stress level of nurses
      * Increased rate of errors when individual nurses are assigned to the most acutely ill patients
  + Patient Errors (or their home caregivers)
    - Polypharmacy factors
      * More than 1 doctor/pharmacy without informing everyone of all medications taken
    - Not filling/refilling Rx
    - Taking medications incorrectly
      * A patient may take a medication every other day instead of daily if he/she cannot afford it
      * Taking leftover medications from a previous illness

**Strategies for reducing medical errors 2**

* + Assessment
    - Ask patient about allergies, health concerns, use of OTC meds/supplements
    - Ensure the patient has been receiving the right dose of meds, at the right time, by the right route.
    - Assess organ function that could affect pharmacotherapy
    - Identify patient education needs regarding medications
  + Planning
    - Avoid use of abbreviations/mnemonics
    - Question unclear orders
    - Do not accept verbal orders
    - Follow policy and procedure
    - Have patient restate dosing directions, including the correct dose and time
    - Ask patient to demonstrate an understanding of the goals of therapy
  + Implementation
    - PAY ATTENTION
    - Practice the rights (patient, route, time, drug, dose, *documentation*)
    - Follow the following steps:
      * Positively ID the patient using 2 means
      * Use correct procedures & techniques for all routes
      * Calculate the dose correctly; measure liquids carefully
        + DOUBLE CHECK; have another nurse or pharmacist check
      * Open meds immediately prior to administration and in the presence of the patient
      * Record on MAR immediately
      * Confirm the patient has swallowed the meds
      * Do not crush long-acting oral meds and tell patient not to
  + Evaluation
    - Determine if therapeutic effects (i.e. – normal BP after receiving antihypertensives) or adverse effects have occurred.
  + **Fatal errors**
    - Most common is improper dose
    - Followed by wrong drug and wrong route
    - Almost half occurred in patients >60
    - Children are also vulnerable
  + Always know drug standard before administering (that way, when an MD writes 500mg instead of 50mg, you can catch the error)
    - NEVER give a drug you are unfamiliar with (both uses and side effects)

**Categories of medication errors 2**

* + - Category A – Circumstances or events that had potential to cause an error
    - Category B – Error that did not reach the patient (an “error of omission” does reach the patient)
    - Category C – Error that reached the patient but did not cause harm
    - Category D – Error that reached the patient and required monitoring to confirm that it resulted in no harm to the patient and/or required intervention to preclude harm
    - Category I – Error that may have contributed to or caused patient death

**Importance of policies and procedures 1**

* Following policy and procedures is an integral step in preventing medication errors
* Also, covers your butt – if you can prove you followed policy and procedure and a problem occurred, it can relinquish you of legal blame for an error.

**The impact of medication errors 1**

* + *The misery of the patient will be prolonged*
  + Medication errors are the most common cause of morbidity and preventable death within hospitals
  + Devastating emotional impact on the person who made the error
  + Increased costs
  + Patient inconvenience, harm, or death
  + Each error or potential for one should be investigated to identify ways to prevent future errors
    - In a nonpunitive way to encourage staff to report errors, building a culture of safety
    - In order to implement new policies/procedures to reduce/eliminate errors

**Reporting and documenting medication error 1**

* + **Goal =** Safe and effective patient care and patient medication administration
  + FDA has coordinated the reporting of medication errors at the federal level
    - MedWatch (the FDA Safety Information and Adverse Event Reporting Program)
      * Provides information about safety issues involving medical products (including drugs)
    - The FDA encourages nurses and other HCPs to report medication errors for its database, which is used to assist others in avoiding similar mistakes
    - Errors, or situations that can lead to errors, can be reported anonymously directly to the FDA by telephone or online
      * Since 1992, they have received over 30,000 error reports
  + National Coordinating Council for Medication Error Reporting (NCC MERP)
    - Goal to standardize the medication error reporting system, examine interdisciplinary causes of errors, and promote safety
    - They also provide medication error prevention education
  + Documentation is essential for legal reasons, so do it right…
  + Root Cause Analysis (RCA)
    - What happened, why did it happen, and what can be done to prevent it from happening again?
  + **Reporting the Error**
    - The nurse making or observing the error should complete an Incident Report
    - This allows the nurse to identify factors that contributed to the medication error, which is helpful in avoiding future errors
    - This is not included in the patient’s medical record – it’s used by the agency’s risk management personnel (i.e. – for implementing RCA), and for nursing administration/education
  + **Sentinel Events**
    - Sentinel event = unexpected occurrence involving death or serious physical or psychological injury, or risk thereof – JC

These are always investigated and interventions put in place to ensure that such an event does not recur (using RCA).

**Documenting in the patient’s medical record/importance 1**

* + **Documenting in the Patient’s Medical Record**
    - Errors should be documented in a factual manner
    - Documentation should include nursing interventions that were implemented to protect the patient, such as monitoring VS and assessing for potential complications
      * Failure to report these implies either negligence or lack of acknowledgement that an error occurred.
    - The medication administration record (MAR) should contain documentation of errors as well.
  + **Importance**
    - The safety of the patient
    - In case of error, using the information to prevent error recurrence

**Medication errors 1**

* + FDA’s MedWatch – safety info and adverse event reporting program
  + ISMP – Institute of Safe Medication Practice – accepts error reports, publishes *Safe Medicine* newsletter about errors
  + The USP’s MEDMARX – anonymous error-reporting system

**Chapter 13**

**Autonomic nervous system 1**

* + - * Autonomic NS
        + A division of the peripheral NS
        + Involuntary control over smooth/cardiac muscle and glands

**Sympathetic nervous system 1**

* + - Sympathetic Nervous System (SNS)
      * Fight or flight
      * Activation under stressful conditions
      * Dilates pupils, inhibits salivation, accelerates heart, dilates bronchioles, inhibits digestion, stimulates release of glucose, secretes epinephrine/norepinephrine, relaxes bladder, inhibits sex organs

**Adrenergic receptor activation/agonist 2**

* + - Receptors = **adrenergic receptors**
      * **ALPHA**
        + NT = NE
        + If you stimulate an alpha-adrenergic receptor you usually get vasoconstriction and CNS stimulation
        + **alpha1**

Effects: vasoconstriction, dilation of pupils

Locations: all sympathetic organs except the heart

* + - * + **alpha2**

Effect: inhibition of release of NE

Location: presynaptic adrenergic nerve terminals

* + - * **BETA**
        + NT = Epi
        + If you stimulate a beta-adrenergic receptor you get cardiac stimulation; bronchial/GI/uterine muscle relaxation (smooth muscle); and glycogenolysis (breakdown of glycogen into glucose for fuel)
        + **beta1**

Effects: increased heart rate and force of contraction; release of renin

Locations: Heart and kidneys

(beta**1** =one heart)

* + - * + **beta2**

Effect: inhibition of smooth muscle

Location: all sympathetic organs except the heart (bronchioles, arterioles, visceral organs)

(beta**2**=two lungs)

* + - Sympathomimetics act by directly activating adrenergic receptors or indirectly by increasing the release of norepinephrine from nerve terminals
      * Direct
        + Bind to and activate adrenergic receptors
        + i.e. – the endogenous catecholamines (Epi, NE, dopamine)
      * Indirect
        + Cause release of NE from its vesicles on the presynaptic neuron
        + Inhibit the reuptake/destruction of NE
        + i.e.: amphetamine, cocaine

**Adrenergic antagonist 1**

* + Adrenergic antagonists – inhibit the SNS
  + Produce many of the same effects as cholinergic agents (parasympathomimetics)
    - COUNTERACT fight of flight mechanisms
    - Rest-and-digest symptoms
  + Wide therapeutic application in the treatment of hypertension
  + They act by directly blocking adrenergic receptors
    - Either Alpha or Beta blockers

**Beta Agonist/use 1**

* + - **Beta1**
      * Treatment of cardiac arrest
      * Treatment of heart failure
      * Treatment of shock
    - **Beta2**
      * Treatment of asthma
      * Treatment of premature labor contractions

**Beta blockers/precautions 2**

* + - Precautions
      * Because they are used to lower blood pressure, they can lower it too much!
      * Change positions slowly, avoid caffeine, avoid alcohol and hazardous activities, report side effects, don’t stop abruptly
      * Assess VS before administering (don’t give if BP is low!!!)
      * Assess history of COPD/asthma, hypotension, dysrhythmias, HF

**Beta blockers atenolol, metoprolol (selective)/adverse effects 2**

* + - * **Beta blockers atenolol, metoprolol (selective)/adverse effects:**
        + Selective = heart-specific side effect
        + Side Effects: Bradycardia, heart failure, pulmonary edema, hypotension, fatigue, dizziness, depression, lethargy, NVD (nausea/vomiting/diarrhea), impotence

**Beta blockers (non-selective) propranolol/adverse effects 1**

* + - * **Beta blockers (non-selective) propranolol/adverse effects**
        + Non-selective beta blockers also affect the heart, but in addition they can cause asthma-like symptoms (due to bronchospasm)
        + Can also cause life-threatening skin side-effects (erythema multiforme, exfoliative dermatitis, Stevens-Johnson syndrome, and toxic epidermal necrolysis)

**Anti-cholinergic drug/contraindication 3**

* **Clinical Applications of Anticholinergics** (13.10)
  + Anticholinergics – inhibit PSNS impulses
  + This suppression induces a fight-or-flight response
    - Dilation of pupils, urinary retention, slowing of GI motility, increase in heart rate, drying of secretions, relaxation of bronchi
  + Historical example of an anticholinergic = belladonna “pretty woman” – women used to apply it to their faces to get rosy cheeks and dilated, doe-like eyes…
  + The most accurate term for this class is muscarinic antagonists because they are selective for ACh muscarinic receptors (and have little effect on nicotinic receptors)
  + They act directly by competing with ACh for binding muscarinic receptors
  + Therapeutic uses (try and figure out why based on known effects):
    - GI disorders, Ophthalmic procedures, Cardiac rhythm abnormalities, preanesthesia, asthma
  + Examples:
    - Atropine (prototype drug)
      * Antidote for cholinergic agent poisoning (medications/pesticides/poisonous mushrooms)
    - Deltrol
      * Helps with urinary incontinence (“Gotta-go-gotta-go” commercial)
    - Scopolamine (Hyoscine)
      * Produces sedation; prevents motion sickness
    - Benztropine (Cogentin)
      * Reduces muscular tremors/rigidity of Parkinson’s disease
    - Ipratropium (Atrovent)
      * Safer than many other anticholinergics, because it is applied as an aerosol spray (producing more local effects)
      * Used to treat COPD
  + Side Effects:
    - High incidence
    - Small doses decrease HR but larger doses INCREASE HR
    - Tachycardia, dysrhythmias, ischemia (restriction of blood supply), CNS stimulation, constipation, urinary retention in men with prostate disorders, dry mouth, dry eyes, sweating inhibition (heat stroke!), photophobia (due to pupil dilation), decreased bronchial secretions
    - Overdose (anticholinergic crisis) symptoms:
      * Fever, visual changes, difficulty swallowing, psychomotor agitation, hallucinations
      * “Hot as hades, blind as a bat, dry as a bone, mad as a hatter.”
  + Nursing Implications:
    - Assess for allergies, BPH, glaucoma, tachycardia, MI, CHF, hiatal hermia, GI or GU obstruction
    - Take baseline VS
    - Overdose can be life-threatening
    - Blurred vision side effect can be dangerous if driving/operating machinery
    - Apply sunglasses/sunscreen for photosensitivity
    - Apply pressure to inner canthus (the medial corner of the eye over the nasolacrimal duct) to prevent systemic absorption
    - Monitor side-effects
  + Contraindications:
    - Glaucoma, acute hemorrhage, tachycardia, GI obstruction

**Cholinergic agonist/side effect/myasthenia gravis 1**

* + Parasympathomimetics – stimulate the PSNS and produce symptoms of rest-and-digest response
    - Increase secretions (including salivation & sweating) and peristalsis, increase urinary frequency, constrict pupils, reduce intraocular pressure
  + Acetylcholine is an NT in the SNS, PSNS, and skeletal muscle… so obviously drugs like ACh (cholinergic agents) will have widespread/varied effect**s**
  + Subclasses
    - Direct-acting agents
      * + i.e. – bethanechol (Urecholine)
      * Bind to cholinergic receptors to produce rest-and-digest response
      * They have longer-lasting effects (because they are more resistant to acetylcholinesterase (the enzyme that breaks down ACh))
      * Direct-acting agents = moderately selective = **muscarinic agonists**
    - Indirect-acting agents
      * + i.e. – neostigmine (Prostigmin)
      * They inhibit the action of acetylcholinesterase (AChE) allowing endogenous (natural) ACh to not be destroyed!
      * In other words, they help prolong the action of the body’s own ACh
      * Indirect-acting agents = nonselective = **cholinesterase inhibitors**
    - Used to treat myasthenia gravis (an AI disease which leads to destruction of nicotinic receptors in skeletal muscles)
      * + Because direct-acting cholinergic agents are more selective for muscarinic receptors, we can bet that drugs for myasthenia gravis (a nicotinic receptor related disorder) will be indirect-acting cholinergic agents!
      * Administration of cholinergic agents (pyridostigmine or neostigmine) stimulates skeletal muscle contraction, which helps reverse symptoms of severe muscle weakness
      * It can be administered before meals to help patients chew their food
    - Side Effects:
      * “SLUDGE”
      * Salivation, Lacrimation, Urinary incontinence, Diarrhea, Gastrointestinal cramps, Emesis
  + #1 cholinergic inhibitor – narcotics (they cause diarrhea)

**Chapter 18**

**Nonpharmacological Techniques for Pain Management 2**

* + Techniques:
    - Acupuncture
    - Biofeedback Therapy
    - Massage
    - Heat or cold packs
    - Meditation or prayer
    - Relaxation therapy
    - Art or music therapy
    - Imagery
    - Chiropractic manipulation
    - Hypnosis
    - Therapeutic or physical touch
    - Transcutaneous electrical nerve stimulation (TENS)
    - Energy therapies (i.e. - Reiki and Qi Gong)

**Neural Mechanism of control/Substance P / Aδ and C fiber 3**

* + Pain transmission begins when pain receptors (nocicpetors – free nerve endings) are stimulated
  + The pain impulse is sent to the spinal cord by Aδ and C fibers.
    - Aδ fibers – lightly myelinated (fast)
      * Signal sharp, well-defined pain
    - C fibers – unmyelinated (slow)
      * Signal dull, poorly-localized pain
  + From the spinal cord the message is transmitted to the brain by a NT called **substance P**
    - Spinal NT (substance P) is critical – it **controls whether or not pain is detected by the brain**

**Treatment for opioid dependence 1**

* + People who abuse opioids quickly become tolerant to euphoric effects and subsequently increase dose/frequency. When physically dependent patients attempt to discontinue drug use, they experience extremely uncomfortable symptoms, so this convinces many people to continue using, so as to avoid this suffering.
  + Physical dependence can be overcome by stopping for 7 days, but psychological dependence can occur up to years following discontinuation. This means that significant support groups are paramount.
  + **Treatment:**
    - Switching dependent patients to methadone (Dolophine), which does not cause euphoria.
      * The patient must then continue taking methadone (to avoid withdrawal symptoms) until the patient decides to enter a total withdrawal treatment program
      * This method allows patients to return to functioning without the physical, emotional, and criminal risks of illegal drug use
    - Administering buprenorphine (Subutex) sublingually
      * This is a mixed opioid agonist-antagonist
      * It prevents opioid withdrawal symptoms
      * The patient is later switched to a buprenorphine-naloxone combination for maintenance

**Narcotic: Morphine/mechanism of action/side effects 2**

* + **Prototype: Morphine**
    - **Mechanism of action**
      * Binds with mu and kappa receptors
    - Effects:
      * Euphoria
      * Constriction of the pupils
      * Stimulation of cardiac muscle
    - Use
      * Relief of serious acute/chronic pain
      * Preanesthetic medication
      * Relieve shortness of breath associated with
        + MI
        + HF
        + Pulmonary edema
    - **Adverse Effects**
      * Dysphoria (restlessness, depression, anxiety)
      * Hallucinations
      * Nausea
      * Constipation
      * Dizziness
      * Itching
      * Cross tolerance to other opioids
    - Overdose
      * Severe respiratory depression
      * Cardiac arrest
    - Contraindications
      * Gallbladder disease
        + Intensify or mask the pain
      * Acute/severe asthma
      * GI obstruction
      * Severe hepatic or renal impairment
    - **Overdose treatment**
      * IV naloxone (most preferred)
      * Activated charcoal
      * Laxatives

**Opioid Antagonist action/mechanism 1**

* + Opioid antagonists prevent the effects of opioid agonists
    - If they compete with opioids for access to the opioid receptor they are called competitive antagonists
  + Any opioid can be abused for its psychoactive effects, but morphine, heroine, and meperidine are preferred for their potency
    - Heroin is considered too dangerous for therapeutic use in the US thought it is used as an analgesic in many countries (!!!)
  + Because of opioids potential for dependence and abuse which can lead to toxicity and overdose, opioid antagonists are often used to reverse symptoms of opioids.
    - Acute opioid is a medical emergency and requires immediate infusion with an opioid antagonist, such as naloxone (Narcan)
    - Respiratory depression is the most dangerous problem requiring reversal
  + In situations where the patient is unconscious or it is unclear which drug has been used, an opioid antagonist maybe used to diagnose the overdose. If it fails to quickly reverse acute symptoms, the OD can be attributed to a nonopioids substance

**Pharmacotherapy with NSAIDS 1**

* **Pharmacotherapy with NSAIDs** (18.8)
  + NSAIDs – act by inhibiting pain mediators at the nociceptor (peripheral) level.
    - Pain mediators: histamine, potassium ion, hydrogen ion, bradykinin, and prostaglandins
  + They inhibit Cyclooxygenase (COX), an enzyme responsible for the formation of prostaglandins
    - Thereby reducing pain and inflammation
  + Appropriate for mild to moderate pain (especially when associated with inflammation)
  + NSAIDs have analgesic activity, but unlike opiates, they also have antipyretic (anti-fever) and anti-inflammatory activity
  + **Aspirin & Ibuprofen**
    - Inhibit both COX-1 and COX-2 enzymes.
  + **Celecoxib (Celebrex)**
    - Inhibits only COX-2 enzyme
    - COX-2 is more specific for the synthesis of inflammatory prostaglandins, so this provides more peripheral pain relief (but there are more side effects)

**Classification of Opioid receptor 1**

* + Opioid receptor types:
    - Mu (types 1 and 2)
      * Analgesia, decreased GI motility, euphoria, respiratory depression, sedation, physical dependence
    - Kappa
      * Analgesia, decreased GI motility, sedation, miosis
    - Sigma
    - Delta
    - Epsilon

**Opioid adverse effects 1**

* Most important/dangerous is respiratory depression
* Constipation
* Sedation
* Nausea
* Orthostatic hypotension

**Migraine Headache? 1**

* + **Migraine**
    - The most painful type of headache
    - Characterized by throbbing, pulsing pain, preceded by an **aura**
      * A sensory cue that lets the patient know of an oncoming migraine
        + i.e. – jagged lines, flashing lights, special smells, tastes, sounds
    - Most migraines include nausea and vomiting

Triggers: MSG, nitrates, red wine, perfumes, food additives, caffeine, chocolate, aspartame **Migraine Headache/Sumatriptan/Adverse effect 1**

* **Drug Therapy for Migraine Headaches** (18.10)
  + There are 2 pharmacologic goals for antimigraine agents:
    - Stop migraines in process
    - Prevent migraines from occurring
      * Drug therapy is most effective if begun before a migraine has reached a severe level.
    - 2 major antimigraine drug classes, both of which are serotonin (5-HT) agonists (vasoconstrictors):
      * Triptans
        + Action: constricts certain intracranial vessels
        + Prototype: **sumatriptan (Imitrex)**

Therapeutic Class: vascular headache suppressants

Pharmacologic Class: 5-HT agonist

Action: vasoconstriction in large intracranial arteries

Adverse Effects: dizziness, vertigo, MI, tingling, warm sensation, angina

* + - * Ergot Alkaloids
        + Action: promotes vasoconstriction
        + Use: terminates ongoing migraines
        + Adverse Effects: GI upset, weakness (multiple, since they interact with adrenergic and dopaminergic and serotonergic receptors)
        + Pregnancy Category X
        + i.e. – ergotamine
  + Drugs for Migraine Termination:
    - Pharmacotherapy for migraine termination begins with acetaminophen/NSAIDs.
    - If these do not work, the drugs of choice are the triptans
    - If triptans do not work, the ergot alkaloids may be used
  + Drugs for Migraine Prophylaxis
    - Initiated only if the incidence of migraines is high, and patient is unresponsive to the other drugs used to abort them
    - Propanolol (Inderal)
      * A beta-blocker
      * Most common prescription
    - Amitriptyline (Elavil)
      * An antidepressant
      * Preferred for patients whose migraines accompany a mood disorder/insomnia
  + Nursing Interventions:
    - Assess frequency, intensity, coping
    - Provide quiet, calm environment
    - Assess pain level before and after med

**Chapter 33**

**Role of chemical mediators in inflammation 1**

* + Chemical mediators are “alarms” that notify surrounding area of an injury
  + Examples:
    - **Histamine**
      * Stored/released by mast cells
      * Causes vasodilation, smooth muscle constriction, swelling, and itching
    - Leukotrines
      * Stored/released by mast cells
      * Effects similar to histamine
    - Bradykinin
      * Present in inactive form in plasma and mast cells
      * Causes vasodilation 🡪 pain
      * Effects similar to histamine
    - Complement
      * Series of proteins that combine and cascade to neutralize/destroy antigens
    - Prostaglandins
      * Stored/released by mast cells
      * Present in most tissues
      * Increases capillary permeability, attracts WBC to site, and causes pain
  + Mast cells = cells in connective tissue that detect inflammation and release histamine to initiate the inflammatory response
    - This causes plasma, complement proteins, and phagocytes to flood the area and neutralize foreign agents
  + Drugs that are histamine receptor antagonists are used to treat allergic rhinitis (stop inflammation from occurring
  + Rapid release of chemical mediators 🡪 ANAPHYLAXIS

**NSAIDs/labs to monitor/maximum dose 2**

* **Treating Inflammation with NSAIDs** (33.4)
  + NSAIDs have analgesic, antipyretic, and anti-inflammatory properties, and are prescribed for mild to moderate inflammation
  + They have a relatively high safety margin and are available OTC
  + Different NSAIDs have about the same efficacy, but vary in their adverse effects
  + Note: acetaminophen is NOT an NSAID – it has no anti-inflammatory action (even though it is an analgesic/antipyretic)
  + NSAIDs can differ in their duration of action, which is important for longterm users
  + They can also produce varied responses – some patients respond better than others to a particular drug
  + Action of NSAIDs:
    - They inhibit the synthesis of prostaglandins
      * Prostaglandins = Lipids that promote inflammation, among other potent physiologic effects
    - They do so by inhibiting the enzyme that helps make prostaglandins – cycolooxygenase (COX)
  + COX subtypes:
    - COX-1 – present in all body tissues and serves protective functions:
      * Reducing gastric acid secretions
      * Promoting renal blood flow
      * Regulating smooth muscle tone in blood vessels and the bronchial tree
    - COX-2 – formed only after tissue injury
      * Promotes inflammation
    - First generation NSAIDs (ibuprofen, aspirin) blocked both COX subtypes
      * However, inhibiting COX-1 produces undesirable side effects (bleeding, gastric upset, reduced kidney function)…
  + **Salicylates**
    - Aspirin – a long-used nonspecific COX inhibitor
      * (Prevents COX enzymes from forming inflammatory prostaglandins)
    - It has a cardioprotective effect – preventing clot formation and strokes
      * In fact, a single dose of aspirin can inhibit a platelet for its entire 8-11 day lifespan…
        + Therefore, we must monitor patients for bleeding!
    - It is only recommended for mild inflammation, because higher doses may result in a high incidence of side-effects:
      * Epigastric pain, heartburn, stomach bleeding related to ulceration
      * Enteric coating minimizes these effects
    - High doses cause salicylism:
      * Tinnitus, dizziness, headache, excessive sweating
  + **Ibuprofen and Ibuprofen-like NSAIDs**
    - Developed as aspirin alternatives as nonspecific COX inhibitors
    - These NSAIDs can affect platelet function, but they have a lower risk than with aspirin
  + **Selective COX-2 Inhibitors**
    - Because they do not inhibit COX-1, they do not produce adverse effects on the GI system, and do not affect coagulation ☺
    - However, after postmarketing data revealed that rofecoxib (Vioxx) doubled the risk of heart attack and stroke in those taking it for extended periods, the number of COX-2 inhibitors on the market was reduced to only 1 – celecoxib (Celebrex)
    - Celecoxib is used as an anti-inflammatory
      * It is also used to reduce the number of colorectal polyps in adults with FAP (familial adenomatous polyposis)
* **Labs to Monitor**
  + BUN/creatinine (to assess kidney function)
  + Liver enzymes (to assess for hepatic impairment)
  + CBC/Hb/hematocrit (to assess for blood loss)
  + Clotting profile (pt, ptt) (to assess for clotting impairments)
  + Serum salicylate levels (for aspirin, to assess for salicylism)
* **NSAIDs maximum doses**
  + Aspirin = 4g (4,000mg)/day
  + Ibuprofen = 3.2g (3,200mg)/day
  + Naproxen = 1g (1,000mg)/day

**Treating acute or severe inflammation with glucocorticoid/adverse effect 2**

* + Because of serious adverse effects, systemic glucocorticoids are reserved for short-term treatment of severe disease – and they are the most effective at treating severe inflammation.
  + Endogenous glucocorticoids are hormones released by the adrenal cortex that have powerful effects on nearly every cell in the body
  + Uses:
    - Neoplasia
    - Asthma
    - Arthritis
    - Corticosteroid deficiency (Addison’s Disease/hypoadrenocorticism)
  + Multifaceted Action:
    - Inhibit biosynthesis of prostaglandins
    - Suppress histamine release
    - Inhibit certain functions of phagocytes/lymphocytes
  + Adverse effects of systemic Glucocorticoids:
    - Suppress adrenal glands (adrenal insufficiency)
    - Hyperglycemia (diabetes)
    - Mood changes
    - Cataracts
    - Peptic ulcers
    - Electrolyte imbalances (related to impairment of adrenal function)
    - Osteoporosis
    - They can also mask infections, which can spread dangerously if they go undetected
      * For this reason, an infection is a contraindication for glucocorticoid therapy
  + When longer therapy is warranted, doses are kept as low as possible to avoid these adverse effects
    - * i.e. – it may be given every other day to encourage the adrenals to function on the off days.
      * Overtreatment can lead to Cushing’s syndrome (hyperadrenocorticism)
      * Dose must be decreased gradually because the body becomes adjusted to high doses (abrupt withdrawal can result in acute lack of adrenal function)

**Fever/Acetaminophen/mechanism of action 1**

* Maximum dose (just in case) is 4g (4,000mg)/day
* Remember that acetaminophen has a low therapeutic index – this is very important for toxicity issues
  + Fever is a natural defense mechanism for neutralizing foreign organisms
    - Many spp. of bacteria are killed by a high fever
    - However*, too* high a fever can be dangerous!
      * This causes the HCP to need to weigh whether a fever should be dealt with aggressively or allowed to run its course
  + Drugs used to treat fever = antipyretics
  + Fever is normally merely a discomfort
    - However, prolonged, high fever can be dangerous:
      * Young children can experience febrile seizures
      * In adults, fever can break down body tissues, reduce mental acuity, and lead to delirium or coma (esp. in elderly patients)
      * Fever can lead to death in rare cases
  + Goal of therapy:
    - To lower body temperature while treating the underlying cause of the fever (i.e. – infection)
  + Antipyretics:
    - Aspirin, ibuprofen, and acetaminophen
  + Most fevers are caused by infectious processes, but drugs can also cause them – if an infection cannot be found, the nurse should consider this as a possible source
* **Acetaminophen**
  + Therapeutic: antipyretics, nonopioid analgesics
  + Pharmacologic: centrally acting COX inhibitor (but it doesn’t have anti-inflammatory effects)
  + Action: it reduces fever at the level of the hypothalamus (by inhibiting prostaglandins which may serve as mediators of pain and fever) and dilation of peripheral blood vessels, which enables sweating and dissipation of heat.
  + Adverse effects: hepatotoxicity